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Eckenroth et al.

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(45) **Date of Patent: Jun. 16, 2009**

(54) **METHOD AND SYSTEM FOR AUTOMATICALLY ANALYZING AND MODIFYING CABLE TELEVISION SIGNAL LEAK INFORMATION**

(75) Inventors: **Kenneth J. Eckenroth**, Rowlett, TX (US); **Michael E. Ostteen**, Rowlett, TX (US)

(73) Assignee: **Cable Leakage Technologies, Inc.**, Wylie, TX (US)

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(51) **Int. Cl.**
G01S 3/52 (2006.01)
H04N 7/00 (2006.01)

(52) **U.S. Cl.** **342/418**; 725/107

(58) **Field of Classification Search** 342/417–418, 342/450, 458–460; 725/107, 124, 125; 348/192
See application file for complete search history.

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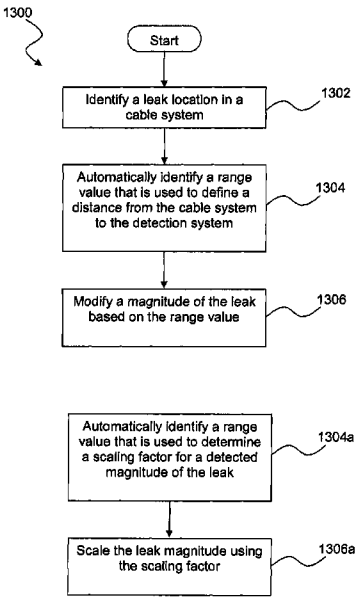
Primary Examiner—Dao L Phan
(74) *Attorney, Agent, or Firm*—Haynes and Boone, LLP

(57) **ABSTRACT**

Provided are a system and method for modifying detected radio frequency (RF) leak information in a cable television system. In one example, the method includes identifying a leak location and a leak magnitude in the cable television system using a detection system. A predefined range value may be automatically identified based on the leak location, where the range value is used to define an approximate distance between the cable television system and the detection system. The leak magnitude may then be modified based on the range value.

29 Claims, 9 Drawing Sheets


1300
Start
Identify a leak location in a cable system
1302
Automatically identify a range value that is used to define a distance from the cable system to the detection system
1304
Modify a magnitude of the leak based on the range value
1306
Automatically identify a range value that is used to determine a scaling factor for a detected magnitude of the leak
1304a
Scale the leak magnitude using the scaling factor
1306a

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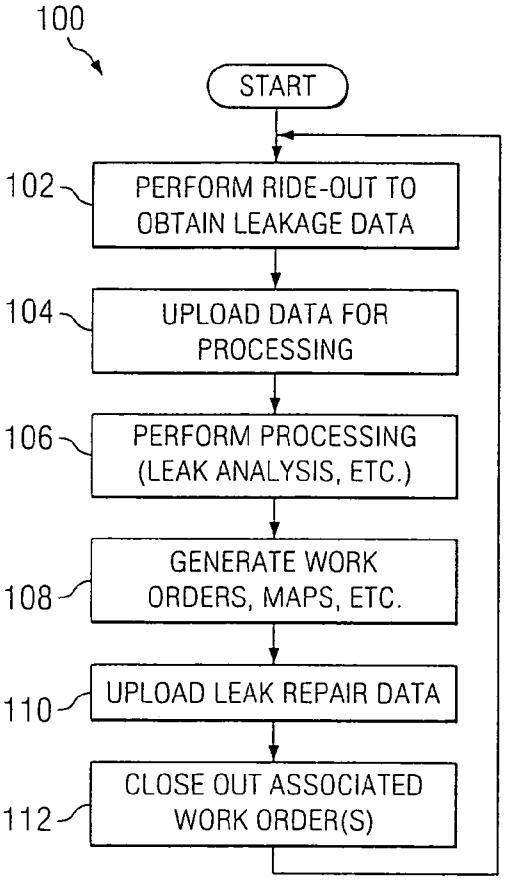

100
START
102
PERFORM RIDE-OUT TO OBTAIN LEAKAGE DATA
104
UPLOAD DATA FOR PROCESSING
106
PERFORM PROCESSING (LEAK ANALYSIS, ETC.)
108
GENERATE WORK ORDERS, MAPS, ETC.
110
UPLOAD LEAK REPAIR DATA
112
CLOSE OUT ASSOCIATED WORK ORDER(S)

Fig. 1

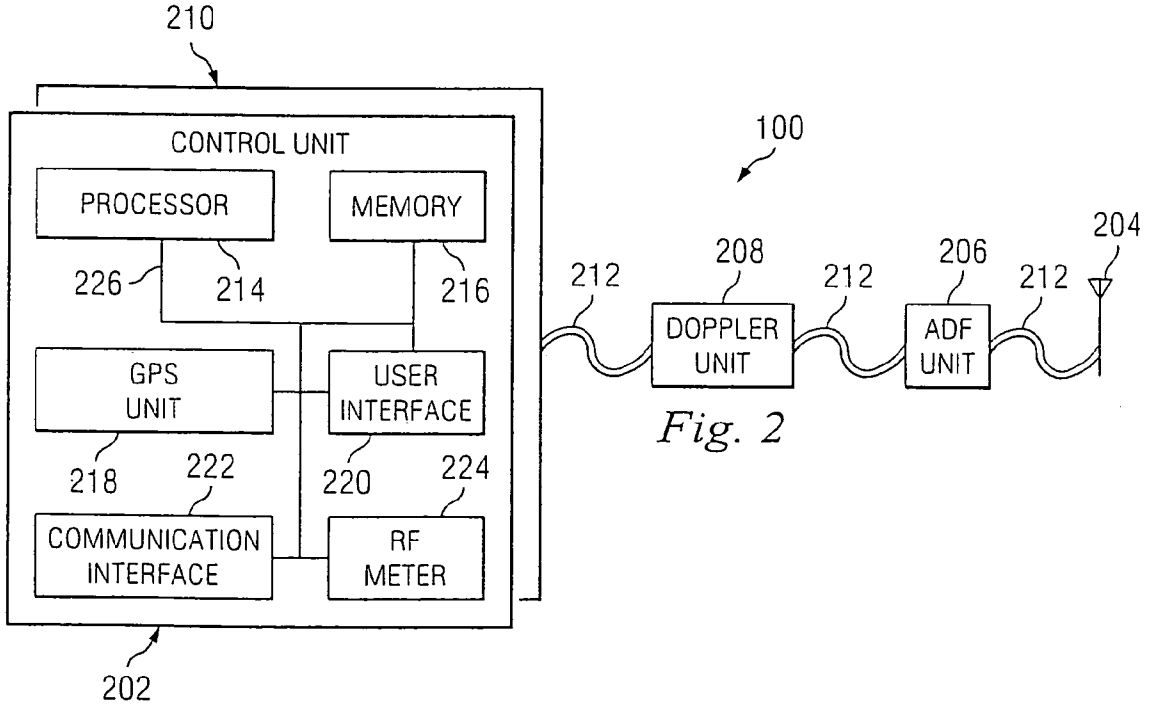

210
CONTROL UNIT
PROCESSOR
MEMORY
226
214
216
GPS UNIT
USER INTERFACE
218
222
220
224
COMMUNICATION INTERFACE
RF METER
202
100
212
208
DOPPLER UNIT
212
206
ADF UNIT
212
204

Fig. 2

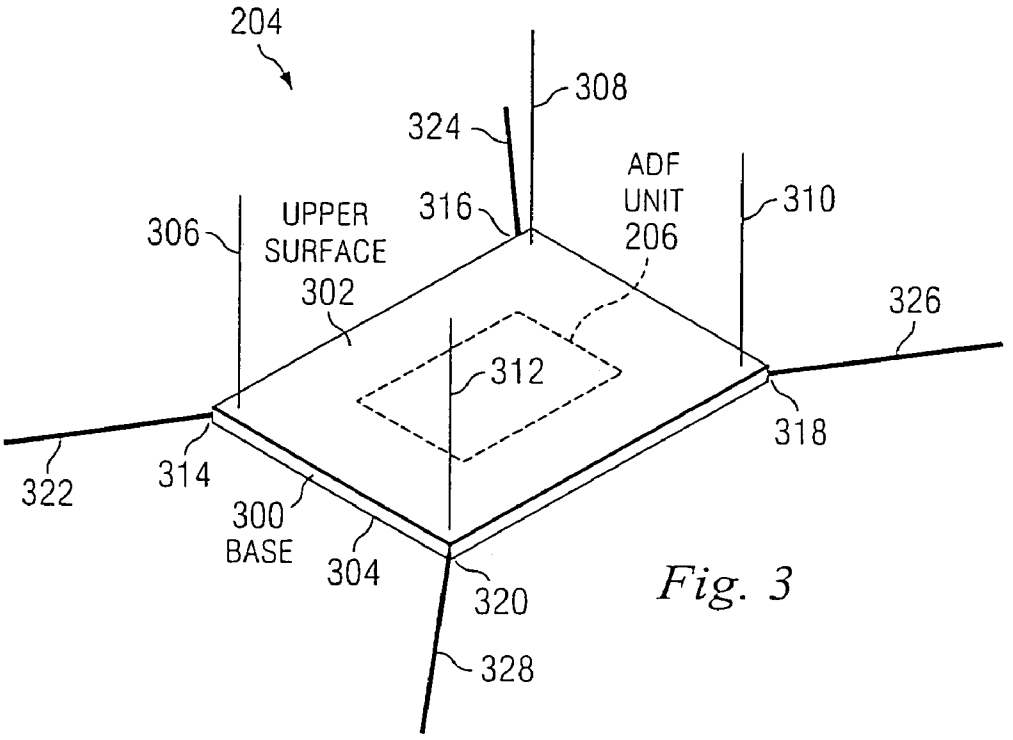

204
308
324
ADF
UNIT
206
310
306
UPPER
SURFACE
302
316
326
312
318
322
314
300
BASE
304
320
328

Fig. 3

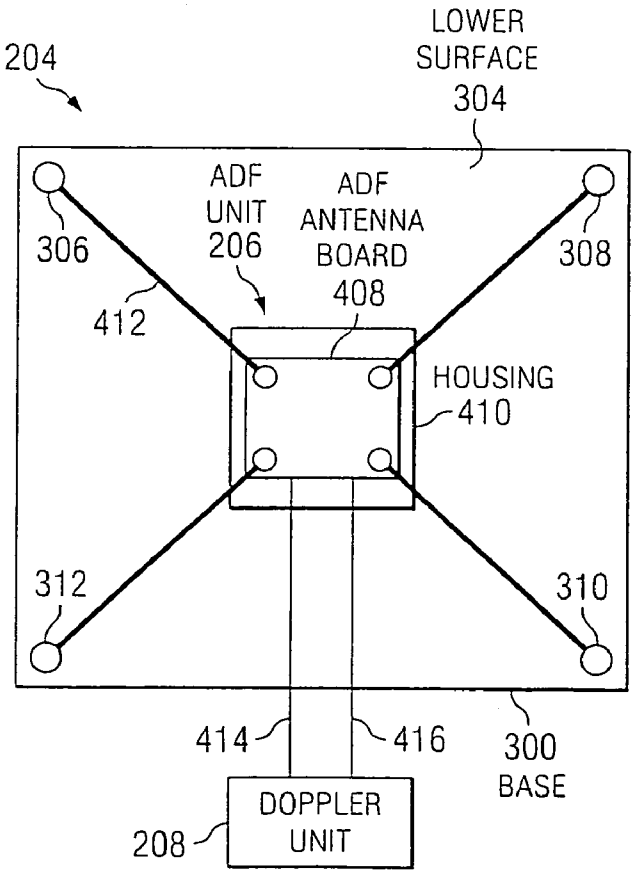
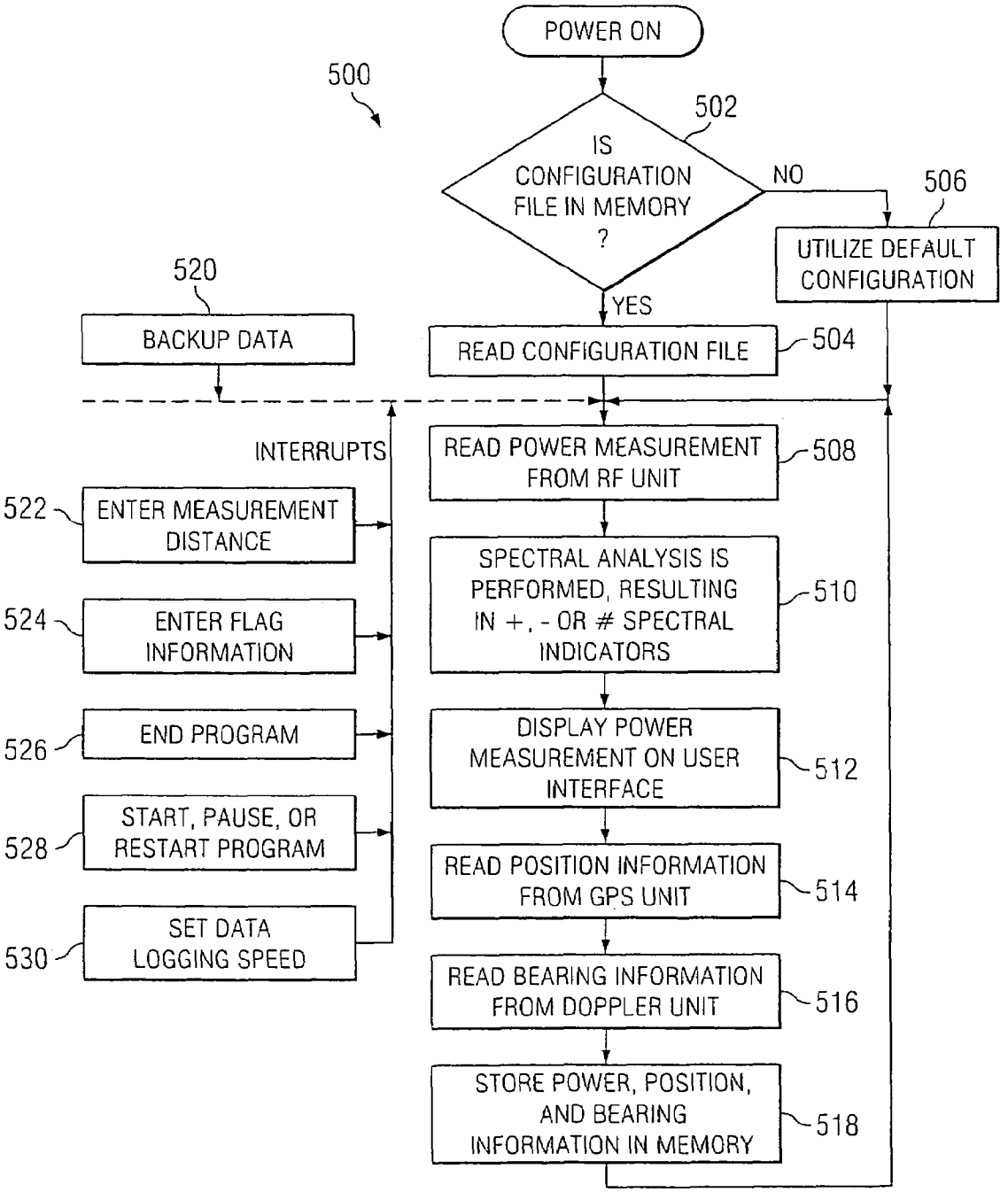

204
LOWER
SURFACE
304
ADF
UNIT
206
ADF
ANTENNA
BOARD
408
306
308
412
HOUSING
410
312
310
414
416
300
BASE
DOPPLER
UNIT
208

Fig. 4

Fig. 5


500
POWER ON
502
IS CONFIGURATION FILE IN MEMORY ?
NO
506
UTILIZE DEFAULT CONFIGURATION
YES
520
BACKUP DATA
READ CONFIGURATION FILE
504
INTERRUPTS
READ POWER MEASUREMENT FROM RF UNIT
508
522
ENTER MEASUREMENT DISTANCE
SPECTRAL ANALYSIS IS PERFORMED, RESULTING IN +, - OR # SPECTRAL INDICATORS
510
524
ENTER FLAG INFORMATION
526
END PROGRAM
DISPLAY POWER MEASUREMENT ON USER INTERFACE
512
528
START, PAUSE, OR RESTART PROGRAM
READ POSITION INFORMATION FROM GPS UNIT
514
530
SET DATA LOGGING SPEED
READ BEARING INFORMATION FROM DOPPLER UNIT
516
STORE POWER, POSITION, AND BEARING INFORMATION IN MEMORY
518

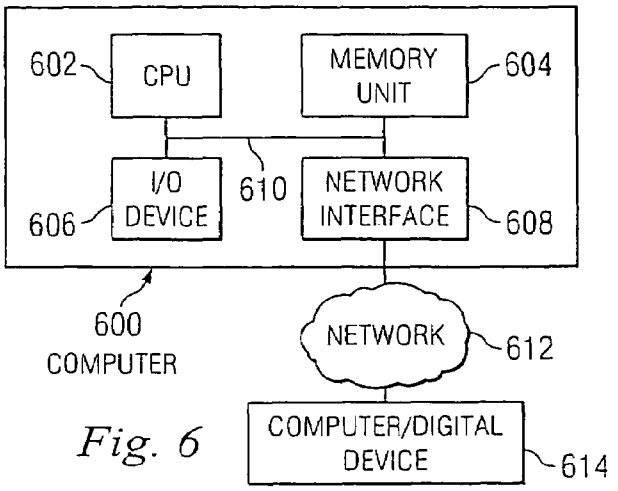


Fig. 6

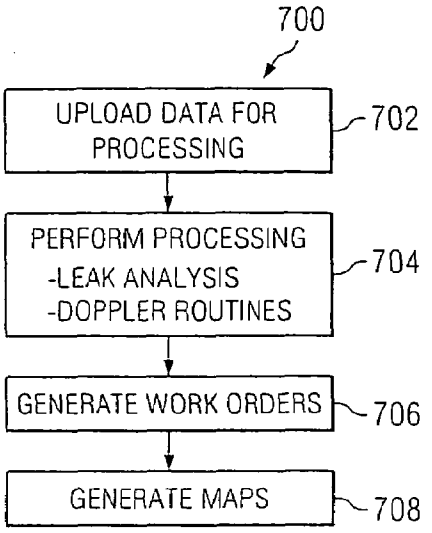


Fig. 7

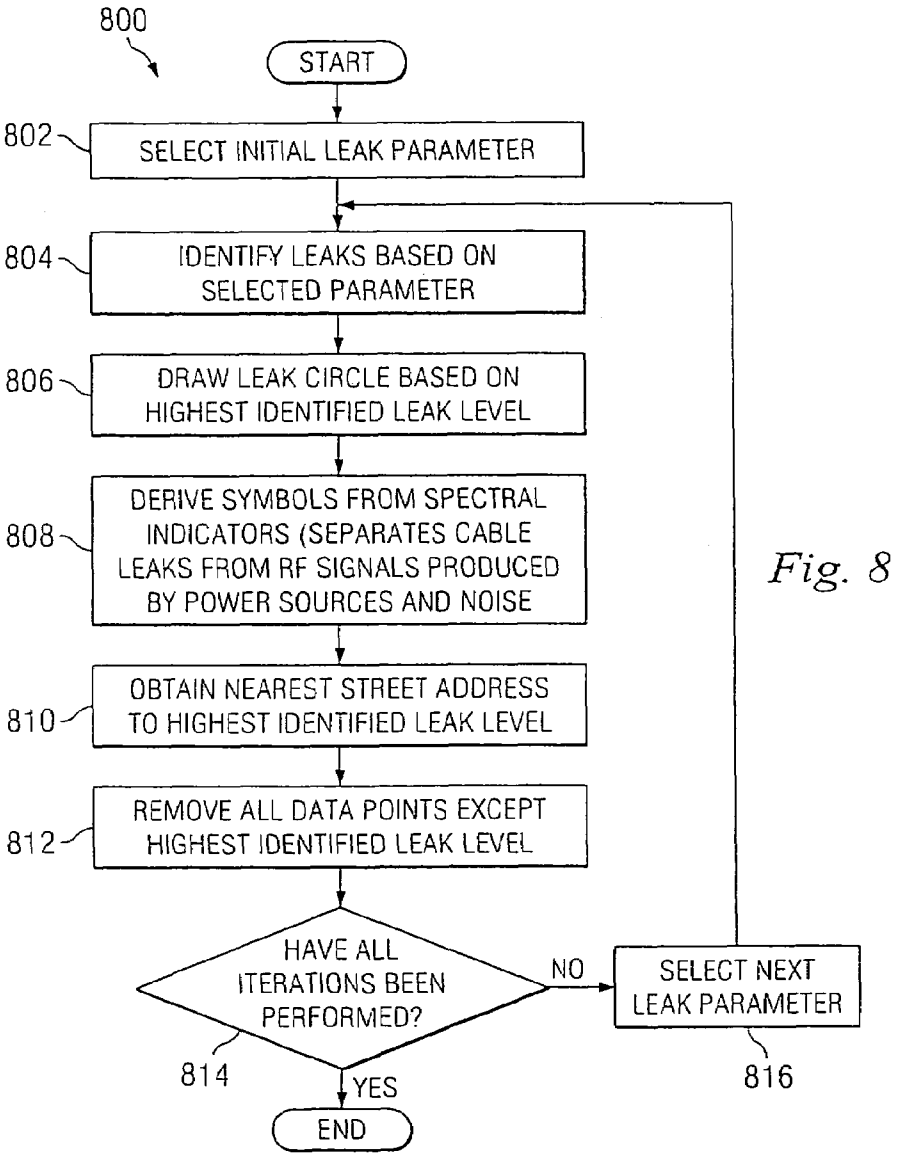


Fig. 8

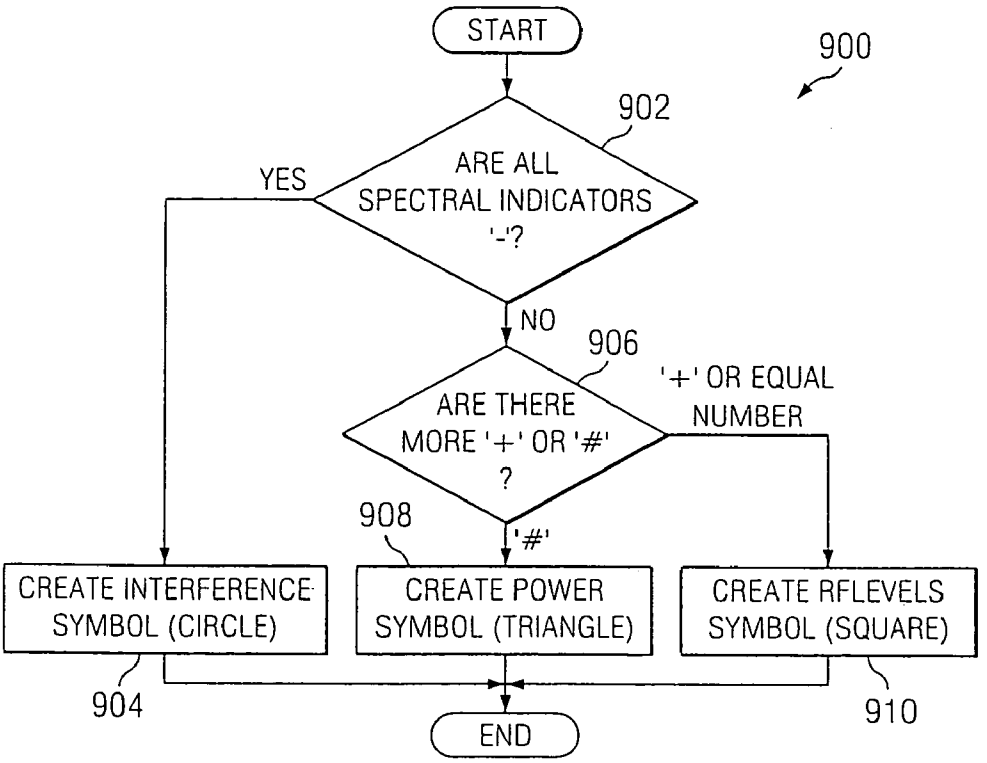

START
900
902
ARE ALL SPECTRAL INDICATORS '-'?
YES
NO
906
ARE THERE MORE '+' OR '#' ?
'+' OR EQUAL NUMBER
908
'#'
CREATE INTERFERENCE SYMBOL (CIRCLE)
CREATE POWER SYMBOL (TRIANGLE)
CREATE RFLEVELS SYMBOL (SQUARE)
904
910
END

Fig. 9

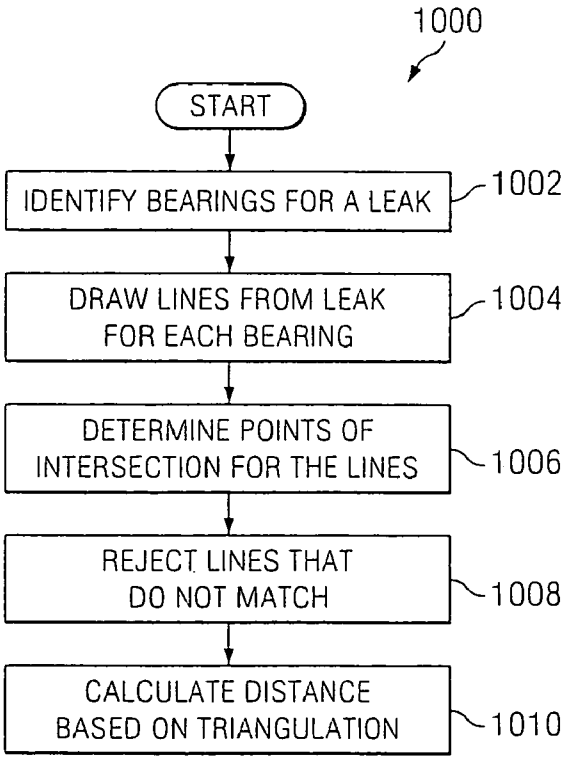

1000
START
IDENTIFY BEARINGS FOR A LEAK
1002
DRAW LINES FROM LEAK FOR EACH BEARING
1004
DETERMINE POINTS OF INTERSECTION FOR THE LINES
1006
REJECT LINES THAT DO NOT MATCH
1008
CALCULATE DISTANCE BASED ON TRIANGULATION
1010

Fig. 10

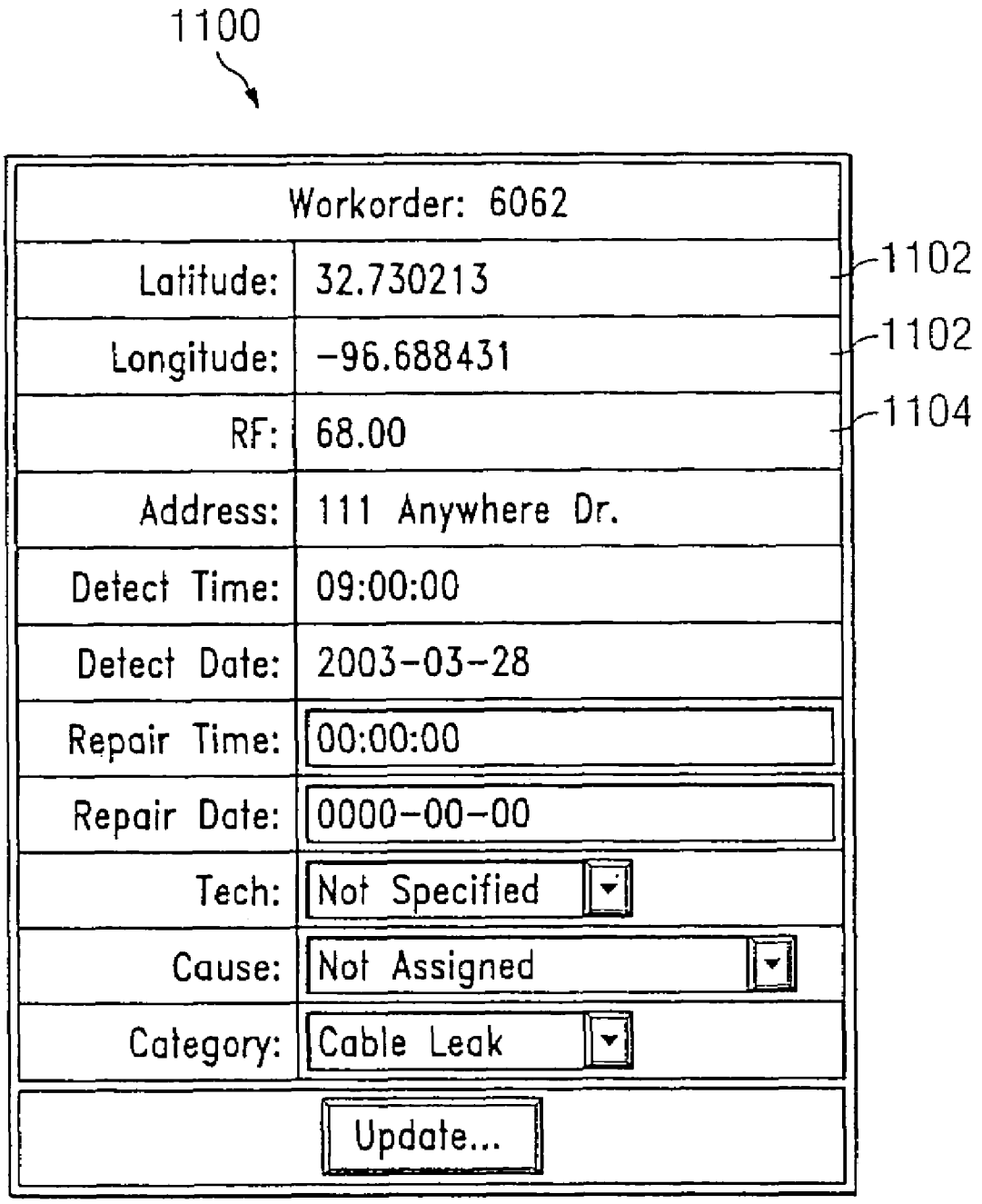

1100
Workorder: 6062
Latitude: 32.730213
Longitude: -96.688431
RF: 68.00
Address: 111 Anywhere Dr.
Detect Time: 09:00:00
Detect Date: 2003-03-28
Repair Time: 00:00:00
Repair Date: 0000-00-00
Tech: Not Specified
Cause: Not Assigned
Category: Cable Leak
Update...
1102
1102
1104

Fig. 11

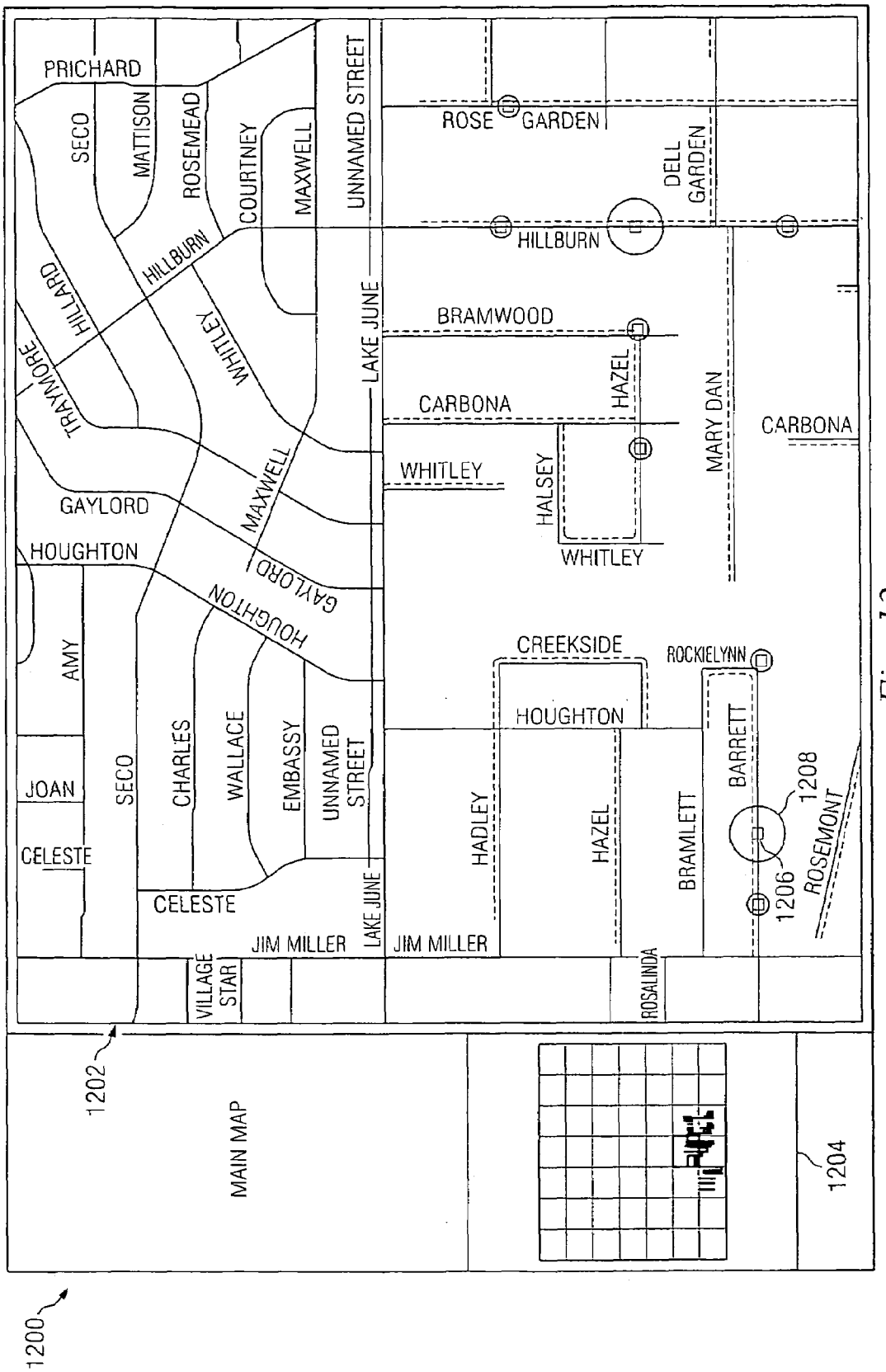

PRICHARD
SECO
MATTISON
ROSEMEAD
COURTNEY
MAXWELL
UNNAMED STREET
ROSE GARDEN
DELL GARDEN
HILLBURN
HILLARD
TRAYMORE
WHITLEY
LAKE JUNE
BRAMWOOD
HAZEL
CARBONA
MARY DAN
HALSEY
GAYLORD
MAXWELL
HOUGHTON
AMY
JOAN
CELESTE
SECO
CHARLES
WALLACE
EMBASSY
UNNAMED STREET
CREEKSIDE
ROCKIELYNN
BARRETT
HADLEY
BRAMLETT
ROSEMONT
1208
1206
JIM MILLER
VILLAGE STAR
ROSALINDA
1202
MAIN MAP
1204
1200

Fig. 12

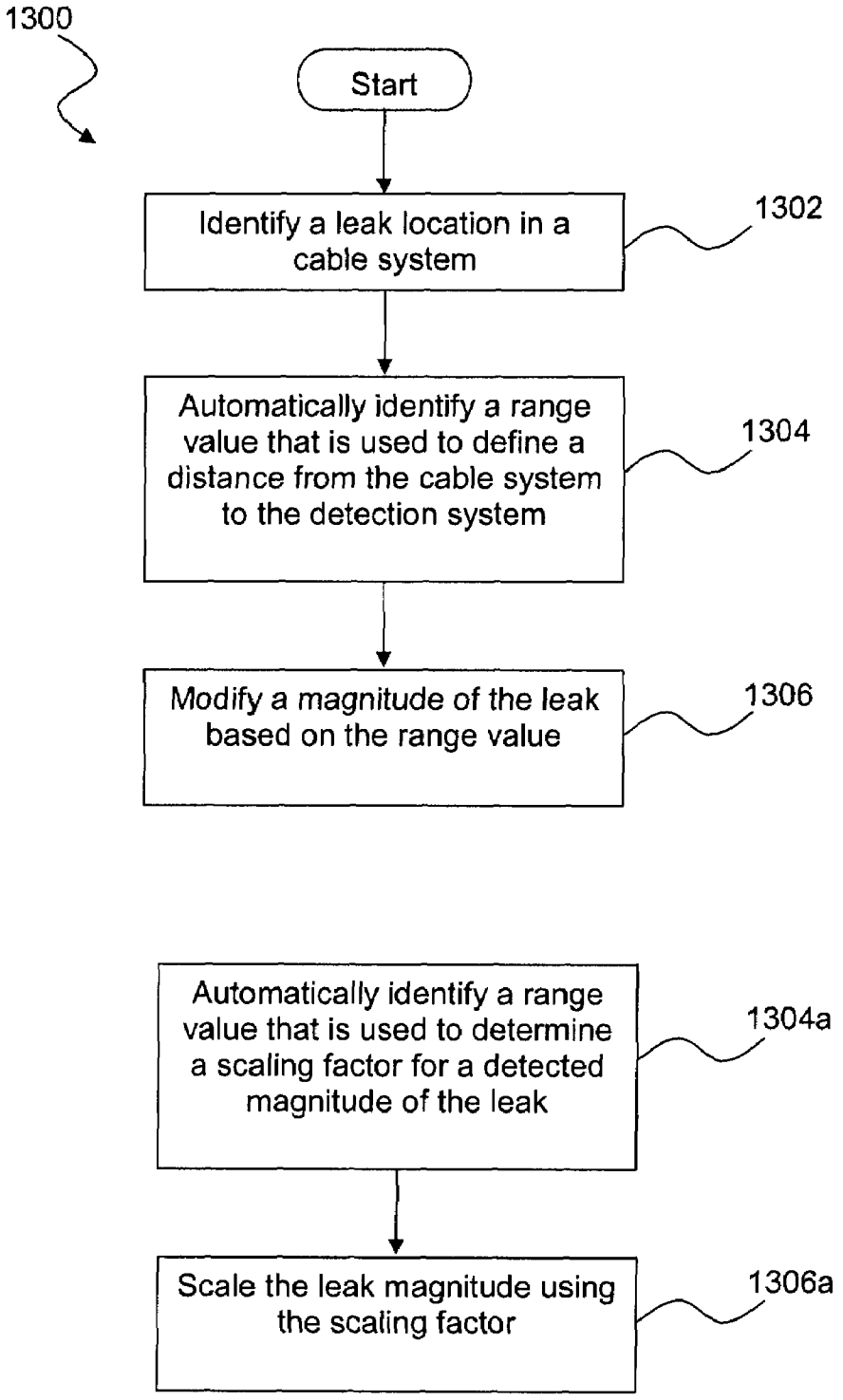

1300
Start
Identify a leak location in a cable system
1302
Automatically identify a range value that is used to define a distance from the cable system to the detection system
1304
Modify a magnitude of the leak based on the range value
1306
Automatically identify a range value that is used to determine a scaling factor for a detected magnitude of the leak
1304a
Scale the leak magnitude using the scaling factor
1306a

Fig. 13

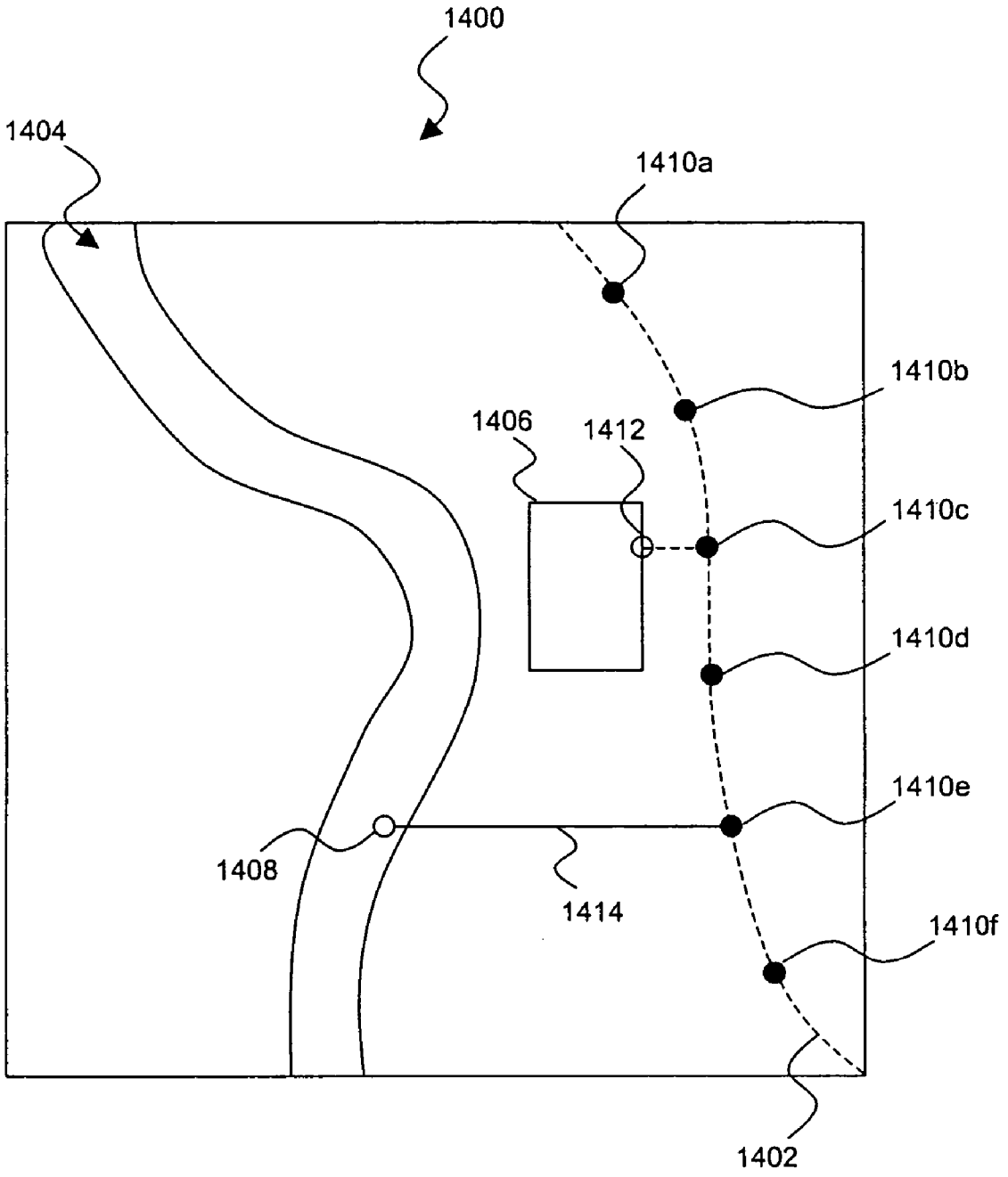

1400
1404
1410a
1410b
1406
1412
1410c
1410d
1410e
1408
1414
1410f
1402

Fig. 14

METHOD AND SYSTEM FOR AUTOMATICALLY ANALYZING AND MODIFYING CABLE TELEVISION SIGNAL LEAK INFORMATION

CROSS-REFERENCE

This application is a continuation-in-part of U.S. patent application Ser. No. 10/414,771, filed on Apr. 16, 2003, and entitled "DOPPLER-BASED AUTOMATED DIRECTION FINDING SYSTEM AND METHOD FOR LOCATING CABLE TELEVISION SIGNAL LEAKS."

BACKGROUND

Cable television is a system (e.g., a cable "plant") for delivering television signals to subscribers or viewers by means of coaxial cable. When signals above a certain power level leak from the cable plant into the atmosphere, they may conflict with those used by the aviation industry. Signal leakage can occur in a variety of situations, such as when the shielding of cable cracks or becomes weathered, when connectors become loose, or when the cable breaks.

Rules promulgated by the Federal Communications Commission (FCC) require cable television operators to monitor their cable plants, including their transport media (e.g., cables). Among other items, these rules cover monitoring and reporting on signal "leaks" that occur in the cables. To comply with these standards, cable companies must make power measurements of their facilities and report data obtained during the measurements to the FCC.

Although various methods have been developed to locate cable television leaks, each method presents one or more disadvantages. For example, some methods lack effectiveness in locating or identifying leaks, while others are costly or time consuming.

Accordingly, what is needed is a system and method for accurately locating and identifying leaks.

SUMMARY

Provided is a system and method for detecting and modifying cable leakage information. In one embodiment, the method includes identifying a leak location and a leak magnitude in a cable television system using a detection system. A range value may be automatically identified based on the leak location, where the range value is used to define an approximate distance between the cable television system and the detection system. The leak magnitude may then be modified based on the range value.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flow chart of an exemplary method for collecting, processing, and provisioning cable leakage data to an end user.

FIG. **2** is a block diagram illustrating components of an exemplary Doppler-based leak detection system that may be used in the method of FIG. **1**.

FIG. **3** is a perspective view of an antenna from the system of FIG. **2**.

FIG. **4** is an underside view of the antenna of FIG. **3**.

FIG. **5** is a flow chart of an exemplary method for collecting and storing cable leakage data using the leak detection system of FIG. **2**.

FIG. **6** is an exemplary computer system that may be used to process and provision data collected using the method of FIG. **5**.

FIG. **7** is a flow chart of a data processing method that may be performed using the computer system of FIG. **6**.

FIG. **8** is a flow chart of a leak analysis that may be performed by the method of FIG. **7**.

FIG. **9** is a flow chart of one method by which radio frequency sources may be assigned symbols by the method of FIG. **7**.

FIG. **10** is a flow chart of a Doppler routine that may be performed by the method of FIG. **7**.

FIG. **11** is an exemplary screen shot of a work order that may be generated by the method of FIG. **7**.

FIG. **12** is an exemplary screen shot of a map that may be generated by the method of FIG. **7**.

FIG. **13** is a flow chart of an exemplary method that may be used to modify leak information based on a predefined range value.

FIG. **14** illustrates an exemplary environment within which the method of FIG. **13** may be implemented.

DETAILED DESCRIPTION

The present disclosure relates generally to detecting cable leakage and, more specifically, to a system and method for locating and identifying cable television signal leaks. It is understood, however, that the following disclosure provides many different embodiments or examples. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed.

Referring to FIG. **1**, in one embodiment, a method **100** illustrates the collection, processing, and provisioning of data that is obtained using a cable leakage detection system. As will be described later in greater detail, the method **100** begins in step **102**, where a ride-out is performed. During the ride-out, a vehicle containing the cable leakage detection system traverses a route. The cable leakage detection system automatically stores information about leaks that are detected along the route, such as radio frequency (RF) intensity (e.g., amplitude), location, etc. In step **104**, the data is uploaded to a computer for processing.

In step **106**, the computer performs data processing operations, which may include performing a leak analysis and/or using Doppler-based calculations to isolate a leak's location. In step **108**, work orders may be generated based on the processed data and made available to a user through email, a web page, etc. In addition, street maps may be generated based on the processed data to indicate the locations of leaks. The map generation may include automatically sizing and labeling the maps, and making the maps available to the user. In steps **110** and **112**, leak repair data may be uploaded and the work orders associated with the uploaded data may be closed.

It is understood that the method **100** is only one example and that many of the steps may be completed in a different order, and steps may be added or omitted. For example, the method **100** may generate reports using the data and electronically file the reports with the Federal Communications Commission (FCC).

Referring to FIG. **2**, one embodiment of a detection system **200**, such as may be used in step **102** of FIG. **1**, is illustrated.

The detection system **200** includes a control unit **202**, an antenna unit **204**, an automated direction finding (ADF) unit **206**, and a Doppler unit **208**. The control unit **202**, antenna unit **204**, ADF unit **206**, and Doppler unit **208** may be mounted in a vehicle (not shown). For example, the control unit **202** may be mounted in a docking station **210** in the passenger compartment of the vehicle, with the Doppler unit **208** mounted to the back of the docking station **210**. The antenna unit **204** may be secured to the roof of the vehicle, and the ADF unit **206** may be fastened to the antenna unit **204**. In the present example, the various components **202**, **204**, **206**, **208** are connected by cables **212**, but it is understood that wireless, optical, or other connection means may also be used.

The control unit **202** includes a processor/microcontroller **214**, a memory **216**, a global positioning system (GPS) unit **218**, a user interface **220**, a communications interface **222**, and an RF meter **224**. A bus system **226** may be used to connect the various components **214**, **216**, **218**, **220**, **222**, **224**. The processor **214** is connected to the memory **216**, GPS unit **218** (which may be associated with an antenna), user interface **220**, communications interface **222**, RF meter **224**, and Doppler unit **208** (through the docking station **210**). The processor **214** receives bearing information from the Doppler unit **208**, position information from the GPS unit **218**, user input information from the user interface **220**, and RF intensity information from the RF meter **224**. The processor **214** also stores data in the memory **216**. The memory **216** may include permanent memory, removable media (e.g., floppy disks, CD-ROMs, flash cards, etc.), and dynamic memory (e.g., random access memory (RAM)). The communications interface **222** may provide a communications channel between the control unit **202** and the docking station **210**. The communications interface **222** may also include components for use in wired or wireless communications with other devices (not shown). Although not shown in detail, the user interface **220** may include buttons, switches, a keypad, a touch screen, or similar interactive controls that let a user interact with the control unit **102**, as well as a screen display or other output portion.

The RF meter **224** may be configured to measure signals in a broad spectrum of bandwidths, and may also be configured to display the measured signal strength in a variety of formats. For example, cable television operators generally monitor carrier signals in the frequency bands 108-150 MHz. The RF meter **224** may be configured to monitor the signal strength of carrier signals in these frequency bands. In addition, the RF meter **224** may be configured to calculate signal strength measurements based on the distance between the RF meter **224** and the source of the measured signal. The RF meter **224** or the processor **214** may make adjustments to detected leak levels based on a user defined multiplier that is entered into the control unit **202** through the user interface **220**. For example, the control unit **202** may enable the user to indicate a distance from the RF meter **224** to a cable. The distance may be entered or may be selected from a range of distances. The multiplier accounts for the distance, so that selecting a distance of 20 feet results in a multiplier of 2 (e.g., 2× detected leak level). Accordingly, a leak recorded as a 20 would become a leak of 40. Similarly, selecting a distance of 160 would result in the leak being recorded as a **320**. This enables the control unit **202** to account for variations in distance between the RF meter **224** and the source of the leak.

It is understood that certain components that are illustrated as being contained in the control unit **202** may be separate components. For example, the GPS unit **218** and the RF meter **224** may both be separate from the control unit **202** and may communicate with the processor **214** via an interface, such as the communications interface **222**.

Power to the control unit **202** may be provided from a variety of sources, such as an external direct current source (e.g., a vehicle battery). When the control unit **110** is powered on, a software program is executed by the processor **216**, as will be described in greater detail below with reference to FIG. **5**.

Referring now to FIG. **3**, one embodiment of the antenna unit **204** is illustrated in greater detail. In the present example, the antenna unit **204** comprises a relatively rigid square base **300** that is sixteen and a half inches on each side. The base **300** forms a planar surface with an upper surface **302** and a lower surface **304**. Four vertical elements **306**, **308**, **310**, **312** are positioned on the upper surface **302** so that one vertical element is at each corner and oriented perpendicular to the planar surface of the base **300**. Each vertical element **306**, **308**, **310**, **312** is the same length, which may be generally between eighteen and twenty-four inches long. The actual length selected for the vertical elements depends on the wavelength of the signals to be detected. For example, each vertical element may be approximately ¼ wavelength of the target signal. Cable RF signals used for signal leakage are generally in the range of 108-150 MHz. As is known in the art, the ¼ wavelength for the 150 MHz signal may be calculated as 11811 inches/150/4=19.685 inches. Accordingly, a length may be selected for the vertical elements **306**, **308**, **310**, **312** that maximizes performance over the desired range of frequencies. Furthermore, the vertical elements **306**, **308**, **310**, **312** may be spaced to avoid undesirable intercoupling, which may occur with a spacing of ⅛ wavelength.

The base **300** includes four corners **314**, **316**, **318**, **320**. One of four horizontal elements **322**, **324**, **326**, **328** is attached to each corner and oriented parallel with the planar surface of the base **300**. In some embodiments, each corner may be bent upwards or downwards so as to present a small surface that is approximately perpendicular to the planar surface of the base **300**. The horizontal elements **322**, **324**, **326**, **328** may then be attached to the small perpendicular surfaces. The horizontal elements **322**, **324**, **326**, **328** serve to extend the size of the base **300** while providing flexibility. For example, if the horizontal elements **322**, **324**, **326**, **328** are each twenty-four inches long, an additional two feet may be added to each side of the base **300**, depending on the orientation of the horizontal members. Although more than four horizontal elements may be used, it has been discovered that four horizontal elements are generally sufficient to gather the wavelength and the resulting amplitude.

Because the horizontal members **322**, **324**, **326**, **328** are flexible, they can return to their original position after being displaced. For example, the base **300** may be mounted to the roof of a truck that has a ladder rack on each side. The base **300** may be mounted on one or more "legs" (not shown) that raise the base **300** above the ladder racks. Due to the relatively small footprint of the base **300**, not much room is needed. However, the horizontal elements **322**, **324**, **326**, **328** make the base **300** functionally larger and, because they are flexible, they can be displaced by ladders, etc., and return to their original position.

Referring also to FIG. **4**, the ADF unit **206** may be attached to the lower surface **304** of the antenna unit **104**. The ADF unit **106** includes an ADF antenna board **408** that is contained in a housing **410**. The ADF antenna board **408** includes four pin diodes that are connected to the four vertical elements **306**, **308**, **310**, **312** (FIG. **3**) via connections **412**. The ADF antenna board is also connected to the Doppler unit **208** via a coaxial cable **414** and a multiple conductor wire **416**. In operation, the

pin diodes may be switched on and off relatively quickly by the Doppler unit **208**, enabling the coaxial cable **414** to sequence through the vertical elements **306**, **308**, **310**, **312**. In the present example, sixteen points of resolution are provided, with each point representing a direction. It is understood that more points of resolution (e.g., thirty-two or sixty-four) may be used to provide additional directional detail.

Referring now to FIG. **5**, a method **500** (representing a software program) may be used by the cable leakage detection system **200** of FIG. **2** to detect and store leakage data. In general, the method **500** "reads" signal bearing information from the Doppler unit **208** (as detected by the antenna unit **204** and ADF unit **206**), geographic location information (e.g., longitude and latitude) from the GPS unit **218**, and signal strength information (e.g., power) from the RF meter **224**. The method **500** then extracts the read information and stores it in a file in the memory **216**. In the present example, the information is stored in one of four comma delimited text files. The four files pertain to a range of signal strengths. For example, the four files may pertain to signal strength ranges: (1) 0-19 μV/m; (2) 20-49 μV/m; (3) 50-149 μV/m; and (4) 150 μV/m and up.

After the control unit **202** is powered on, the method **500** controls the reading and storing of information received from the Doppler unit **208**, GPS unit **218**, user interface **220**, and RF meter **224**, as well as the display of information through the user interface **220**. The storing of information is performed by writing information to the memory **216**.

At step **502**, the processor **214** of the control unit **202** reads the memory **216** to determine whether a configuration file (not shown) exists on a removable memory device (assuming such a device is present). The configuration file is an editable file that may be used to initialize various parameters of the cable leakage detection system **200**. One such parameter may include the default distance between the RF meter **224** and the source of the measured signal. Another such parameter may include a distance at which measurements from the RF meter **224** may be appended with one or more symbols (e.g., a '*', ' ' (a space), '<', or '>') within one of the four comma delimited text files. Each of these symbols is designated as a "DMARK." The DMARK is used to annotate measurements that are being taken by the RF meter **224**, when the meter is set at a high sensitivity threshold. For example, measurements made at distances greater than 100 feet, may read 25 μV/m while the same reading taken at 20 feet may read 5 μV/m. This DMARK can then be imported along with the measured signal into a mapping program for display. If a configuration file exists on the removable memory device, the method **500** proceeds to step **504**.

At step **504**, the configuration file is read into the memory (RAM) of the control unit **202**. The designated parameters associated with the configuration file are then transferred by the processor **214** to the RF meter **224**. Upon receipt of the parameters, the RF meter **224** begins measuring the designated frequency, and calculates the power of the designated frequency according to the distance parameter provided. If, at step **502**, a configuration file does not reside in the removable memory device, a default configuration file is read, at step **506**, from the memory **216** and transferred to the RF meter **224**, as above. The method **500** then proceeds to step **508**.

At step **508**, the processor **214** of the control unit **202** reads the power measurement from the RF meter **224**. Typically, this power measurement is in numerical units such as 50 μV/m. The power measurement is based on the distance between the RF meter **224** and the source of the measured signal, and relates to the designated frequency band. The method **500** then proceeds to step **510**.

At step **510**, a spectral analysis is performed to identify spectral indicators based on the power measurements obtained in step **508**. The spectral analysis is designed to determine whether a detected RF signal is from a cable leak (CABLE), a power source (POWER), or noise (INTERFERENCE), such as erroneous RF transmissions. In the present example, the following default values (which may be changed by a user) are in use:

Leak levels (μV/m)	1: 200	2: 150	3: 100	4: 50
Search radii (m)	1: 200	2: 150	3: 100	4: 50

The spectral analysis may model the physics of a leak because leaks with larger values radiate further than leaks with smaller values. For example, it would be difficult to find a 50 μV/m leak that is close to a 200 μV/m leak, because the 200 μV/m leak would mask the 50 μV/m leak. This relationship is reflected in the spectral analysis. During the spectral analysis, an initial leak parameter is used to identify level **1** leaks (e.g., leaks of 200 μV/m and higher). A 200 meter leak circle (based on the search radii) is drawn with its origin at the source of the highest leak level. It is understood that a leak circle may not actually be drawn, but that a drawn circle is useful for purposes of illustration. Within the leak circle, the data may be analyzed to identify attributes from which spectral indicators may be derived. For example, spectral indicators may be used to identity whether a detected RF signal is from a cable leak, a power source, or noise. For purposes of illustration, the following spectral indicators are used: '−'=INTERFERENCE; '#'=POWER; '+'=CABLE

In the case of power, the data may be analyzed to identify spikes that rise from a noise floor. If a spike is high enough (when compared to a predetermined level), it is assigned the '#' spectral indicator, indicating that the signal is coming from a power source. Similarly, the data may be analyzed to identify video signatures, in which case the source is assigned a '+' spectral indicator. If the data has no identifiable characteristics, it may be assigned a default symbol, such as the '−' spectral indicator. After the spectral analysis is complete, the method **500** continues to step **512**.

At step **512**, the processor **214** may display the read power measurement via the user interface **220**. At this point, a user of the cable leakage detection system **200** can examine a display associated with the user interface **220** to determine the measured signal strength of the designated frequency band. The method **500** then proceeds to step **514**, where the processor **214** reads geographical position information from the GPS unit **218**. The geographical position information may include such information as longitude, latitude, altitude, and time. The method **500** then proceeds to step **516**.

In step **516**, the processor **214** receives bearing information from the Doppler unit **208**. The Doppler unit **208** may obtain and process bearing information from the antenna unit **204** and ADF unit **206** as follows. In the present example, the Doppler unit **208** rapidly sequences through the pin diodes of the ADF unit **206** and sequentially reads data from each vertical element **306**, **308**, **310**, and **312** of the antenna unit **304**. This provides sets of four readings (e.g., data points) that may then be processed by the Doppler unit **208** to provide bearing information based on the strength of the reading from each vertical element **306**, **308**, **310**, and **312**. As the antenna unit **204** moves relative to a leak, additional bearing information may be obtained that provides additional information regarding the leak's location through, for example, triangulation.

The method **500** then proceeds to step **518**, where the processor **214** stores the power measurement read at step **508**, the longitude and latitude geographic information read at step **514**, and the bearing information read at step **516**, into the memory **216** within the control unit **202**. In the present example, the information is stored as a comma delimited text file (e.g., power, longitude, latitude, bearing). The processor **214** then forms a continuous processing loop by proceeding back to step **508**. The processing loop, which may include steps **508** through **518**, may execute at predetermined intervals, such as once per second. Thus, every second the control unit **202** reads a power measurement from the RF meter **224**, geographic information from the GPS unit **218**, bearing information from the Doppler unit **208**, and stores the power measurement, the longitude and the latitude, and the bearing into a comma delimited text file. This process continues until the control unit **202** is turned off, paused, or until an end command is entered, as discussed below.

The software program embodying the method **500** may include several interrupt routines that are designated as steps **520** through **530**. The first, step **520**, may be used if the comma delimited text file is stored in temporary memory (e.g., RAM) in step **518** or if a backup copy is to be made. For example, the routine may interrupt the continuous loop of steps **508** through **518** at predetermined intervals (e.g., every two minutes) for the purpose of storing the comma delimited text file into the memory **216** (from RAM) or writing the file to a backup disk, such as a floppy disk. This step provides data backup to the control unit **202** such that if power is lost, no more than two minutes (or another predetermined time interval) of data will be lost.

In some embodiments, the processor **214** may perform processing on the comma delimited text file before storing it. For example, the processing may begin when the processor **214** examines the text file to determine the value of the measured power signal for each second of time. The processor **214** extracts the comma delimited text file into one of the four different text files discussed above according to predefined signal strength criteria. For example, one text file may contain power, longitude and latitude, and bearing for power measurements between 0 and 19 μm, a second text file may contain power measurements between 20 and 49 μV/m, a third text file may contain power measurements between 50 and 149 μV/m, and a fourth text file may contain power measurements above 149 μV/m. After extracting the delimited text file into four different text files, the processor **214** may store the files as described. The method **500** then continues the execution loop of steps **508** and **518**.

When the processor **214**, at step **520**, stores the text files, it may first read the memory **216** to determine whether any comma delimited text files already exist. If text files do exist in the memory **216** pertaining to the four signal strength designations, the processor **214** appends the new files onto the preexisting files. Thus, no preexisting files are written over by the processor **214**. If no text files exist in the memory **216** during the execution of step **520**, the processor **214** creates the files and stores the comma delimited text within them.

A second interrupt, step **522**, may occur when a user wishes to change the distance between the RF meter **224** and the measured signal. As described previously, a user may wish to change the distance measurement to provide more accurate power readings depending on the distance to the source of the measured signal. The user enters the desired distance or selects a distance from a predetermined range using the interface **222**. Upon receipt, the RF meter **224** calculates the measured power according to the new distance.

A third interrupt, step **524**, provides a user with the ability to create other comma delimited text files according to his own criteria. The other text files are termed "flag files" and contain a flag letter (e.g., A, B, or C) as well as longitude, latitude, and bearing. This capability allows a user to log to the memory **216** location information of particular observable information such as a broken cable (flag A), a damaged pedestal (flag B), etc. The files may be created using the user interface **220**. The processor **214** stores the flag, along with the most recently read longitude and latitude into a comma delimited text file in the memory **216**. The processor **214** may append subsequent flag entries into existing text files in the manner described above.

A fourth interrupt is provided at step **526** which allows a user to end the method **500**, and thus end the logging of power measurements to the memory **216**. The user can end the method **500**, for example, by pressing a key associated with the user interface **220**. The key press is transmitted to the processor **214**. Upon receipt, the processor **214** stores the existing text files into the memory **216**, discontinues reading information from the Doppler unit **208**, GPS unit **218**, and RF meter **224**, and halts program execution. In some embodiments, the control unit **202** may not be able to restart execution until power is turned off and then back on.

A fifth interrupt is provided at step **528** that allows a user to start, pause, or restart the method **500** from the user interface **220**. For example, the user may toggle between program execution and program pause by pressing one or more keys associated with the user interface **220**. If the method **500** is already being executed, pressing the key may cause the method to pause or suspend execution.

A sixth interrupt may provided at step **530** that allows a user to set the speed at which power, position, and bearing information are read from the RF meter **224**, GPS unit **218**, and Doppler unit **208**, and stored in the memory **216**. The speed may be entered via the user interface **220** by entering a desired time interval or by selecting a time interval from a predetermined range. The processor **214** then logs data at a rate corresponding to the entered speed.

In addition to the above interrupts, a supervisory interrupt (not shown) may be provided that produces an error log of particular error conditions that may occur within the control unit **202**. For example, an error condition may result from the failure of any one of the RF meter **224**, GPS unit **218**, Doppler unit **208**, or user interface **220** to communicate with the processor **214** within the control unit **202**. The error log may be a text file that details the nature of the error and is stored in the memory **216**.

Referring now to FIG. **6**, in another embodiment, an exemplary computer **600**, such as may utilize leakage data collected using the method **500** of FIG. **5**, is illustrated. The computer **600** may include a central processing unit ("CPU") **602**, a memory unit **604**, an input/output ("I/O") device **606**, and a network interface **608**. The components **602**, **604**, **606**, and **608** are interconnected by a bus system **610**. It is understood that the computer may be differently configured and that each of the listed components may actually represent several different components. For example, the CPU **602** may actually represent a multi-processor or a distributed processing system; the memory unit **604** may include different levels of cache memory, main memory, hard disks, and remote storage locations; and the I/O device **606** may include monitors, keyboards, and the like.

The computer **600** may be connected to a network **612**. Because the computer **600** may be connected to the network **612**, certain components may, at times, be shared with other computers and digital devices **614**. Therefore, a wide range of

flexibility is anticipated in the configuration of the computer. Furthermore, it is understood that, in some implementations, the computer **600** may act as a server to other computers **614**.

Referring now to FIG. **7**, in another embodiment, a method **700** illustrates using the computer **600** of FIG. **6** to process data that was collected using the method **500** of FIG. **5**. In the present example, the computer **600** is a server and may be accessed by other computers **614**. In step **702**, data is uploaded to the server **600** for processing. The data may be uploaded to the computer server in a variety of ways. For example, the data may be transferred from the control unit **202** to a computer (e.g., the computer **614**) using removable media (e.g., a floppy disk or flash card), by wireless transfer (e.g., Nextel, CDPD, or GSM/GPRS), by a cable (e.g., a serial cable), or by interfacing the control unit **202** with a docking station connected to the computer **614**. The computer **614** may then transfer the data to the server **600**. In some embodiments, each detection system **200** may be associated with a unique identifier that may be used by the server **600** to identify the source of the uploaded data. Accordingly, a user may initiate an upload procedure by pressing a key associated with the user interface **220** of the control unit **202**, at which time a client program residing on the computer **614** will retrieve the data from the memory **216**, transfer the data to the server **600**, store a backup of the data in the computer **614**'s memory, and delete the files from the memory **216**.

In step **704**, the uploaded data is processed. Exemplary processing may include leak analysis (FIGS. **8** and **9**) and the execution of Doppler routines on the data (FIG. **10**).

Referring also to FIG. **8**, a method **800** illustrates the leak analysis of step **704** in greater detail. Once the data is uploaded to the server **600**, a leak analysis may be initiated that performs a logical search through the data. In the present example, the following default values (which may be changed by a user) are in use:

Leak levels (μV/m)	1: 200	2: 150	3: 100	4: 50
Search radii (m)	1: 200	2: 150	3: 100	4: 50

The leak analysis may model the physics of a leak because leaks with larger values radiate further than leaks with smaller values. For example, it would be difficult to find a 50 μV/m leak that is close to a 200 μV/m leak, because the 200 μV/m leak would mask the 50 μV/m leak. This relationship is reflected in the leak analysis.

In steps **802** and **804**, the method **800** begins with an initial leak parameter and identifies level **1** leaks (e.g., leaks of 200 μV/m and higher). In step **806**, a 200 meter leak circle (based on the search radii) is drawn with its origin at the source of the highest leak level. It is understood that a leak circle may not actually be drawn, but that a drawn circle is useful for purposes of illustration. The method **800** then proceeds to step **808**, where symbols are derived based on spectral indicators (such as those assigned in step **510** of FIG. **5**), as is illustrated in greater detail in FIG. **9**.

Referring also to FIG. **9**, a method **900** assigns symbols based on a previous spectral analysis. It is understood that the spectral analysis may be performed as part of the present step if desired. The symbols are designed to indicate whether a detected RF signal is from a cable leak (CABLE), a power source (POWER), or noise (INTERFERENCE), such as erroneous RF transmissions. The leak analysis, using the results of the method **900** and the previously determined amplitudes and spectral indicators, produces a point file (e.g., a data set) that includes an amplitude, a symbol type, and a spectral indicator for each leak. In the present example, the following indicators and symbols are used:

Spectral indicators: '**–**'=INTERFERENCE; '#'=POWER; '**+**'=CABLE

Symbols: circle=INTERFERENCE; triangle=POWER; square=CABLE

The symbol (circle, triangle, or square) is selected as follows. In step **902**, a determination is made as to whether all the spectral indicators inside the leak circle are '**–**'. If yes, the method **900** proceeds to step **904**, where the INTERFERENCE symbol (circle) is selected. This is the only time the INTERFERENCE symbol is created. If no, the method **900** continues to step **906**, where a determination is made as to whether there are more '**+**' or '#' spectral indicators in the leak circle. The symbol is selected based on a majority, so the POWER symbol (triangle) will be selected if the majority of the spectral indicators are '#' (step **908**), and the CABLE symbol (square) will be selected if the majority of the spectral indicators are '**+**' (step **910**). No majority (e.g., a tie) results in the selection of the CABLE symbol (step **910**).

Referring again to FIG. **8**, after assigning the symbols based on the spectral indicators, the method **800** continues to step **810**, where the street address that is nearest to the highest identified leak level is selected. In step **812**, all the data points in the leak circle are removed except the highest identified leak level. In step **814**, a determination is made as to whether all of the iterations have been performed (e.g., whether leaks have been identified using the predefined parameters). If not, the method **800** proceeds to step **816**, where the next leak parameter is selected. The method **800** then returns to step **804** and identifies leaks, performs spectral analysis, etc., as previously described with respect to steps **804-814**. This enables the method **800** to identify and label smaller leaks that were covered by the highest identified leak level. After the leak analysis is completed, the method **800** ends and the method **700** of FIG. **7** may execute a Doppler routine, as is described in greater in detail with reference to FIG. **10**.

Referring now to FIG. **10**, a method **1000** uses bearing information collected via the Doppler unit **208** to more accurately characterize a leak. Although the method **1000** is illustrated for purposes of clarity as a method separate from the leak analysis method **700** of FIG. **7**, it is understood that the method **1000** maybe integrated into the method **700**.

Doppler based data may be used to overcome problems associated with determining a source of the leak. For example, when a vehicle is on a ride-out, it is difficult to calculate the actual distance from the vehicle to the cable. One way to do this is to use an estimated range, as was described above with respect to FIG. **5**. Another way is to incorporate Doppler data, as this allows such benefits as a triangulation. However, one problem with Doppler based data stems from reflected signals (e.g., multi path). These reflected signals may be detected, even though they are erroneous. Multi path may affect both the amplitude of RF leakage levels and the calculated location of the leaks. As will be described below, the negative effect of multi path may be overcome while processing the bearing data.

In step **1002**, all bearings for each measured leak are identified. In step **1004**, lines are "drawn" (e.g., calculated) out from each measured leak using the bearing information. For example, if bearing information is taken on a single leak once a second for three seconds, there would be three lines drawn from the leak. In steps **1006** and **1008**, points of intersection are determined for the lines associated with each leak and, if a line does not match, it is rejected as being the result of multi path. In some embodiments, a range of intersecting lines may

be averaged during the processing. For example, one line that is twenty feet from a point may be averaged with another line that is forty feet from the point to produce a single line that is thirty feet from the point.

In step **1010**, the distance to the leak can be calculated using triangulation. The calculated distance may then be used to alter the multiplier for that leak to more accurately identify the amplitude of the leak. For example, a leak detected at 4 μV/m with a calculated distance of 80 feet would be identified as a 32 μV/m leak.

The bearing information may also be examined to identify patterns that provide additional details regarding a leak. For example, a leak may be in a cable located at the back of a house, rather than on a pole. During a ride-out, RF signals from the leak may be detected when the detection system **200** is positioned on the road between the house where the leak occurs and a neighboring house, but may be blocked when a house is between the detection system **200** and the leak. Accordingly, data representing the leak will exist for the time the leak is detected (from between the houses), but there will be no data for the positions on either side of the leak (where a house is blocking the leak from being detected). Therefore, by examining the data for a general pattern (such as NULL, leak data, NULL), it may be determined that the leak is at the back of a house, rather than on a pole. Other patterns may be used to identify similar information.

It is understood that the bearing information may be used in addition to the distance information gathered with respect to FIG. **5** (e.g., as a check) or may replace the distance data entirely. After the leaks are processed using the Doppler routine, the method **1000** ends and the method **700** of FIG. **7** continues to step **706**.

Referring again to FIG. **7** and also to FIG. **11**, work orders may be generated in step **706** based on the processing of step **704**. Referring specifically to FIG. **11**, a work order **1100** may include location information **1102**, amplitude of the leak **1104** (which may be corrected using Doppler data as described with respect to FIG. **10**), and additional information. In some embodiments, the work order may be emailed to a technician and/or may be viewed as a web page provided by the server **600**.

Referring again to FIG. **7** and also to FIG. **12**, maps and associated information may be generated in step **708**. Referring specifically to FIG. **12**, a map screen **1200** illustrates a map **1202** of a leakage area may be generated by superimposing the processed data onto a digital map by latitude and longitude. For example, the latitude and longitude of the work order of FIG. **11** may be used to place the leak onto the map of FIG. **12**, along with an associated symbol **1206** as described above (e.g., a square for a cable leak). A circle **1208** may be drawn around each leak to indicate the amplitude of the leak or other information. Flag information (e.g., to indicate a broken wire or a damaged pedestal) may also be indicated on the map or in a comments section. Another map **1204** may reproduce the general area of which the map **1202** is a part. It is understood that the view of the map may be adjustable (e.g., zoomed in or out), and that other known map techniques may be used to alter the map as desired.

Other functionality may be incorporated into the method **700** as desired. For example, a user may access a map or list of ride-outs, along with leaks that were detected during each ride-out. A user may also define leak parameters that are used for processing the data, as well as flags and other information. In addition, the method **700** may be used to generate summaries, reports, or other compilations of data to enable users to more accurately estimate repair costs, equipment upgrades, personnel needs, and perform other planning tasks. Furthermore, the method **700** may incorporate the data into a report, such as is required by the FCC, and automatically file the report.

Referring now to FIG. **13**, in still another embodiment, a method **1300** illustrates the use of predefined range information with the collection, processing, and provisioning of data that is obtained using a cable leakage detection system. As previously described, in some embodiments, a user may make adjustments to a control unit (e.g., the control unit **202** of FIG. **2**) to indicate a distance from an RF meter to a cable. The method **1300** enables the control unit (and/or the computer **600**) to automatically adjust the recorded leak magnitude to account for variations in distance between the RF meter and the source of the leak. In the present embodiment, distance variations may be handled without user intervention by applying one or more dynamically identified and/or predefined range values. The method **1300** may be contained within and executed by the cable leakage detection system **200**, another computer (e.g., the computer **600** of FIG. **6**), or may be distributed between multiple processing devices. For example, portions of the method **1300** may be executed by the cable leakage detection system **200** (e.g., the leak detection), while other portions may be executed by the computer **600** (e.g., further processing of the leak information). Furthermore, portions of the method **1300** may be stored on one device and executed on another device.

In step **1302**, a leak location may be identified in a cable system as previously described. In step **1304**, a range value may be identified. In some embodiments, this range value may be selected from a set of predefined values that are used to define a distance from a point on the cable system to the cable leakage detection system. For example, the cable leakage detection system may be in a vehicle on a nearby road, and each distance may indicate the distance from the cable system to the road. In other embodiments, the range value may be dynamically identified (e.g., using a Doppler system to identify the leak location using triangulation). In still other embodiments, a combination of predefined and dynamic range values may be used. For example, a Doppler system may be used to triangulate the leak location, and the Doppler identified location may be used to identify a nearest predefined range value. Accordingly, is it understood that the range value may be identified using a number of different techniques or a combination of such techniques, and that each technique may use predefined and/or dynamically identified information.

In step **1306**, the leak magnitude may be modified based on the range value. For example, the leak magnitude may be scaled as previously described with respect to the operation of the control unit **202** and the second interrupt (step **522**) of the method **500**. Accordingly, the leak magnitude may be corrected based on the predefined distance information. It is understood that some embodiments may include determining whether such a modification is needed. For example, a scaling value associated with the range value may be checked to determine whether the leak magnitude needs to be modified, and the modification may occur only if the check indicates that the leak magnitude needs to be scaled (e.g., if the distance indicates that the detected leak magnitude is not correct).

The predefined range values may be provided in multiple ways. For example, a user may directly input this information, or previously collected rideout data may be used to automatically extrapolate previously input distance values (e.g., from step **522** of the method **500**).

It is understood that the term "range value" is used to represent many possible values that may be used in the method **1300**. For example, a range value may include longi-

tudinal/latitudinal coordinates, and the distance itself may be calculated using the range value and the cable leakage detection system's longitudinal/latitudinal coordinates. In such an embodiment, the range value's coordinates may be predefined, rather than the distance itself. In other embodiments, the range value may be a scaling factor (e.g., 4). In some examples, multiple sets of range values may be used. For example, a first set of range values may be used to identify cable plant locations that are associated with a line, while a second set of range values may be used to identify cable plant locations that are associated with buildings. In other examples, a range value may have additional information associated with it that negates the need for multiple sets of range values (e.g., a distance and a line/building identifier).

With additional reference to FIG. **14**, an exemplary map **1400** illustrates one possible environment within which the method **1300** may be implemented. The map **1400** illustrates a cable system **1402** running along a street **1404**. A house **1406** is connected to the cable system, and a vehicle carrying a cable leakage detection system **1408** is on the street **1404**. Various map layers may be associated with (e.g., superimposed on) the map **1400**, such as layers for streets, utilities, and additional map layers, including a first map layer containing predefined range values **1410***a*-**1410***f* and a second map layer containing a predefined range value **1412**. It is understood that the map layers may not be visible map layers of the map **1400**, but may represent data that can be used in conjunction with the map. For example, the range values may be associated with map grid coordinates, longitudinal/latitudinal information, etc., for positioning purposes.

A user may directly input the range values into the appropriate map layer using, for example, a utility (e.g., a software program) designed for this purpose or a map editing tool. Alternatively or additionally, a utility may be used that processes previously collected rideout data, automatically extrapolates the range values from previously input distance values, and enters them into the appropriate map layer. Furthermore, compiled location data (e.g., from a cable company responsible for the cable system) may be used to provide the map overlay information.

In the present example, each predefined range value defines an approximate distance from the corresponding point on the cable system **1402** to the cable leakage detection system **1408** (assuming that the detection system is on a certain area on the street). For example, the range value **1410***e* defines a distance **1414**. The range value **1412** defines a distance (or a range of distances) from the house **1406** to the cable leakage detection system **1408** (if the cable leakage detection system was in front of the house).

As is described in greater detail in the following paragraph, it is understood that the range values may not be evenly spaced along the cable system **1402**. For example, one or two range values may be used to indicate a portion of the cable system that is twenty feet from the street, while another range value may be used to indicate a point where the cable system is ten feet from the street. In other embodiments, many range values may be supplied to provide a more accurate representation of the position of the cable system.

In the present embodiment, the street **1404** is divided into multiple street segments (not shown). Each street segment is a line segment with a beginning point and an ending point connected by a line. In general, the more curved the street **1404**, the more street segments will be needed to accurately represent the street. Each street segment may contain data, such as the name of the street and the address range of that portion of the street (e.g., addresses beginning at 100 or 101 and ending at 198 or 199). Each range value may be associated with one of the street segments. As the cable system **1402** changes its range from the street, each street segment will have the correct changing range value.

In some embodiments, a triangulation process (as described above) may be used to provide alternative or additional positioning information about a leak location. For example, triangulation may be used to more accurately locate the leak, which may result in more accurate distance information.

Referring again to FIG. **13** and with continued reference to FIG. **14**, the method **1300** may be applied to the environment of FIG. **14** as follows. The method **1300** begins in step **1302** by locating a leak location. For purposes of example, the leak location is near the range value **1410***e* and the cable leakage detection system **1408** is at the position shown. Accordingly, the distance **1414** separates the leak location and the detection system.

In step **1304**, the range value **1410***e* is identified and the distance **1414** is obtained (e.g., by retrieving a predefined distance or by calculating the distance using coordinates). To identify the range value **1410***e*, a decision may be made as to which of the first and second map layers should be used. For example, the decision may be based on historical leak statistics from the cable system to determine whether most of the previously reported leaks were located in the house or the line. This information may then be used to determine which map layer (and corresponding range values) should be used. Although the present example uses the predefined range value **1410***e*, it is understood that the range value may be dynamically calculated or based on dynamically calculated information. For example, a triangulation process using the previously described Doppler system may be used to identify the leak location, which may then be used to more accurately identify or verify the range value **1410***e*.

In step **1306**, the leak magnitude may be modified based on the distance. For example, if the distance is twenty feet, the leak magnitude may be multiplied by two. Accordingly, the method **1300** enables leak information to be automatically manipulated without requiring constant human intervention.

In other embodiments, geocoded range values may be used for other purposes. For example, such range values may be used as part of a vehicle tracking system, with a path of a vehicle and other information (e.g., a time stamp) appearing on a map or printout. Such range values may also include or be used in conjunction with GPS information. Accordingly, the use of such predefined range values may be applied to many different situations.

While the preceding description shows and describes one or more embodiments, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the present disclosure. For example, although a server is used to describe various embodiments of the present disclosure, another computer or other digital device could also be used. In addition, LORAN or other positioning techniques may be used. Also, other mapping approaches may be utilized as disclosed in detail in U.S. Pat. No. 5,294,937, entitled "CABLE LEAKAGE MONITORING SYSTEM" and assigned to the same assignee as the present disclosure, and hereby incorporated by reference as if reproduced in its entirety. Therefore, the claims should be interpreted in a broad manner, consistent with the present disclosure.

What is claimed is:

1. A computer-executable method for correcting radio frequency (RF) leak information in a cable television system, the method comprising:

identifying a leak location in the cable television system using a detection system, wherein the identifying obtains a leak magnitude;

automatically identifying at least a first range value based on the leak location, wherein the first range value is used to define an approximate distance between the cable television system and the detection system; and

modifying the leak magnitude based on the first range value.

2. The computer-executable method of claim **1** wherein modifying the leak magnitude includes scaling the leak magnitude using the first range value.

3. The computer-executable method of claim **2** further comprising determining whether the leak magnitude should be modified based on the first range value, wherein the determining evaluates a scaling value of the first range value.

4. The computer-executable method of claim **1** wherein the first range value is predefined.

5. The computer-executable method of claim **1** wherein the first range value is dynamically identified.

6. The computer-executable method of claim **1** wherein the first range value includes longitudinal and latitudinal coordinates, and wherein the method further comprises using the longitudinal and latitudinal coordinates to calculate the distance.

7. The computer-executable method of claim **1** wherein the first range value is a scaling factor.

8. The computer-executable method of claim **1** wherein the approximate distance is precalculated and wherein the first range value includes the approximate distance.

9. The computer-executable method of claim **1** further comprising providing an interface to enable a user to directly input the first range value into a computer system.

10. The computer-executable method of claim **1** further comprising extrapolating the first range value from a plurality of previously input distance values.

11. The computer-executable method of claim **1** further comprising importing previously obtained data as the first range value.

12. The computer-executable method of claim **1** further comprising determining whether to use the first range value or a second range value, wherein the first range value is associated with a line and wherein the second range value is used to define an approximate distance between a building containing a portion of the cable television system and the detection system.

13. The computer-executable method of claim **12** wherein determining whether to use the first or second range value includes examining historical information from the cable system to determine whether a majority of previously identified leaks were located in the line or in the building.

14. The computer-executable method of claim **1** wherein identifying the leak location includes using leak data that includes a plurality of data sets, wherein each data set includes a longitude, a latitude, and Doppler-based bearing information, the method further comprising:

analyzing the bearing information associated with the leak;

discarding erroneous bearing information that results from multi path; and

calculating the leak location using a triangulation process based on the longitude, latitude, and bearing information of at least two of the plurality of data sets.

15. The computer-executable method of claim **1** further comprising identifying a street segment associated with the first range value, wherein the street segment defines a specific portion of a street at which the detection system is located.

16. The computer-executable method of claim **15** wherein the street segment includes at least one of a street name and a range of addresses located on the street.

17. A computer system for automatically modifying a detected leak amplitude of a cable television plant leak using at least one predefined range value, the system comprising:

a processor;

a memory accessible to the processor, wherein the memory is operable to store the predefined range values; and

a plurality of instructions for processing by the processor, the instructions for:

automatically identifying a predefined first range value from the predefined range values based on a detected leak location;

using the first range value to identify a scaling factor;

determining whether the leak magnitude needs to be modified based on the scaling factor; and

modifying the leak magnitude based using the scaling factor if the leak magnitude needs to be modified.

18. The computer system of claim **17** further comprising instructions for:

identifying the detected leak location on a map; and

identifying the first range value from a first map layer associated with the map.

19. The computer system of claim **18** further comprising instructions for:

automatically identifying a predefined second range value from the predefined range values based on the detected leak location;

identifying the second range value from a second map layer associated with the map; and

determining whether to use the first or second range value.

20. The computer system of claim **19** further comprising instructions for:

determining whether to use the first or second range value by examining historical data to determine whether the first or second map layer is associated with more previously reported leaks; and

selecting the first range value if the first map layer is associated with more leaks and selecting the second range value if the second map layer is associated with more leaks.

21. The computer system of claim **19** further comprising instructions for:

executing a Doppler-based triangulation process to identify the leak location, and

selecting the first or second range value closest to the identified leak location.

22. The computer system of claim **17** further comprising instructions for generating a map based on the leak location.

23. The computer system of claim **17** further comprising instructions for identifying a street segment associated with the first range value, wherein the street segment defines a specific portion of a street at which the detection system is located.

24. A method for modifying detected radio frequency (RF) leak information of a cable television plant, the method comprising:

analyzing a location of a leak;

automatically identifying a range value based on the leak location, wherein the range value is used to determine a scaling factor for a detected magnitude of the leak; and

scaling the leak magnitude using the scaling factor.

25. The method of claim 24 further comprising determining whether the leak magnitude should be scaled based on the range value prior to scaling the leak magnitude.

26. The method of claim 24 wherein the scaling factor is based on a distance between the leak location and a leak detection system.

27. The method of claim 24 wherein the range value is predefined.

28. The method of claim 24 wherein the range value is dynamically identified.

29. The method of claim 24 further comprising identifying a street segment associated with the range value, wherein the street segment defines a street location from which the leak was detected.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,548,201 B2
APPLICATION NO. : 10/843798
DATED : June 16, 2009
INVENTOR(S) : Kenneth J. Eckenroth et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 10, Line 44, the word "maybe" should read -- may be --

Column 13, Line 6, after "(e.g., 4)," insert the following -- (Step 1304a). Accordingly, the leak magnitude may be scaled using the scaling factor (Step 1306a) --

Signed and Sealed this

First Day of September, 2009

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office